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A Neural Network (NN)-based foF2 model for a single station in the polar cap

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The work on neural networks (NN) by several authors has shown promising results in modeling nonlinear and complex processes in the near Earth space. For instance, NN-based models have been developed to forecast solar and magnetic activity indices, and different ionospheric parameters. However, the developed models have been faced with the challenge of data paucity in the polar region, a major drawback in obtaining suitable relevant models for various geophysical applications in the region.

A neural network based model for the critical frequency of the F2 layer (foF2) has been developed using selected geophysical inputs and observed data from Resolute (74.75° N, 265.00° E) spanning from 1975 –1995 and 2009 –2012, obtained from the Space Physics Interactive Data Resource (SPIDR) and the Canadian High Arctic Ionospheric Network (CHAIN), respectively. A comparison between the NN and the IRI (International Reference Ionosphere) model values with observations was investigated. Both models reproduce the observed diurnal and seasonal variations in foF2 except that the IRI model tends to underestimate the values during low solar activity. The NN model is able to reproduce the enhancements in the foF2 observed in the measurements during the equinoxes, and also shows an improvement in foF2 predictions during disturbed days. An analysis of the root mean square errors (RMSE) computed between the model predictions and observed values show a noticeable margin between the NN and IRI –predicted foF2 values.

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